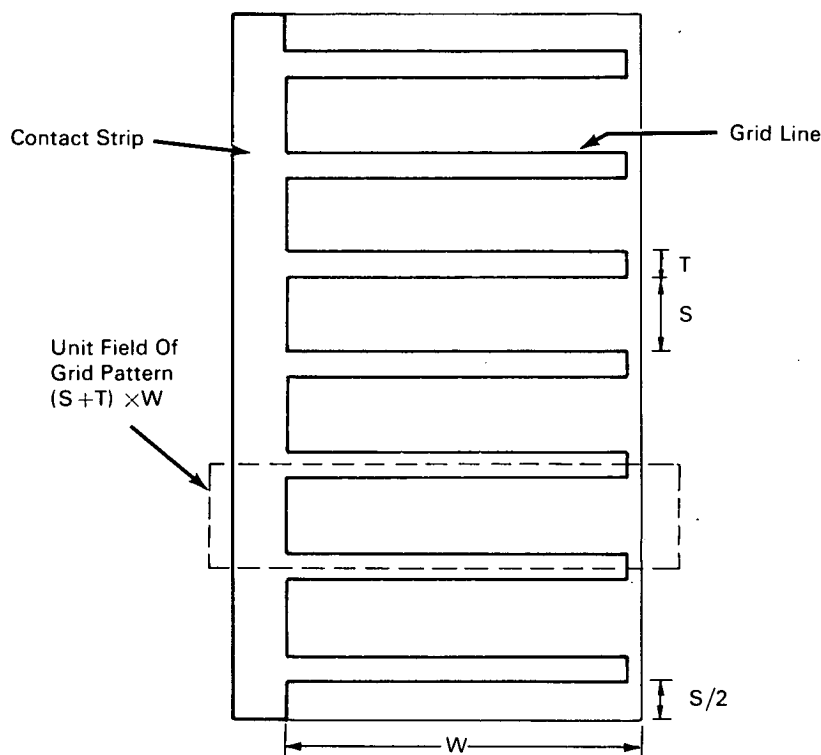


# NASA TECH BRIEF



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## Optimizing Solar-Cell Grid Geometry



Solar Cell And Contact Comb Geometry

The relationship between maximum power output of photovoltaic devices and their surface grid structures is analyzed in an effort to optimize energy conversion efficiencies. Results of this study are readily applicable to new types of solar cells, photodiodes and the general problem area of semiconductor-metal contacts.

### The problem:

Most silicon solar cells are made with metallic grids in the form of combs to aid current conduction in the surface layer and to minimize power loss through

series resistance. However, these grids also shield the surface of the cell beneath them by intercepting the incident light and reducing the light-generated current. A method is required to determine the grid geometry to provide the proper balance between grid resistance and cell output to optimize the energy conversion process.

### The solution:

A trade-off analysis is performed and mathematical expressions are derived to enable optimum grid geometry to be calculated in terms of the various cell parameters.

(continued overleaf)

**How it's done:**

The results of the analysis indicate that the width of each grid line,  $T$ , should be as small as fabrication technology will allow and that the optimum value of the grid aperture width,  $S$ , is a complex function of cell width, sheet resistance of the diffused region, and the voltage and current at the maximum power point. The overall width,  $W$ , and length,  $L$ , of the cell are usually determined by manufacturing convenience or application suitability, and the geometry of the contact strip is fixed by considerations of contact reliability. Parameters taken from conventional cell structures are introduced into the analysis and theoretical calculations made of optimum  $S$  values. Considering the complexity of the interrelated functions, a satisfactory agreement is achieved when compared with experimental data.

**Note:**

Requests for further information may be directed to:  
Technology Utilization Officer  
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National Aeronautics  
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Washington, D.C. 20546  
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No patent action is contemplated by NASA.

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